FCC and ISED Canada Testing of the

Awareness Technology Inc
RFID Reader MCU

In accordance with FCC 47 CFR part 15.225 and ISED Canada's Radio Standards Specifications RSS-210

America

Add value.
Inspire trust.

Prepared for: Awareness Technology Inc
2325 S.W. Martin Hwy.
Palm City, FL 34990

FCC ID: 2BHQI-RFID58
IC: N/A

COMMERCIAL-IN-CONFIDENCE

Document Number: TP0721001855.200 | Version Number: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Dave Ernest	2025 -January-23	
Testing	Thierry Jean-Charles	2025-January-23	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

FCC Accreditation Designation Number US1063 Tampa, FL Test Laboratory	Innovation, Science, and Economic Development Canada Accreditation Site Number 2087A-2 Tampa, FL Test Laboratory

EXECUTIVE SUMMARY
Samples of this product were tested and found to be in compliance with FCC Part 15.225 and ISED Canada's RSS-210.

A2LA Cert. No. 2955.15

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Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2025-January-23

1.2 Introduction

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations Section 15.225 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-210 for the tests documented herein.

Applicant	Awareness Technology Inc
Manufacturer	Palm City, FL 34990
Applicant's Email Address	cmauer@awaretech.com
Model Number(s)	RFID Reader MCU
Serial Number(s)	1,3
FCC ID	2BHQI-RFID58
ISED Certification Number	N/A
Hardware Version(s)	184528SM Rev C
Software Version(s)	0.1.0
Number of Samples Tested	2
Test Specification/Issue/Date	US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2023 Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-210 — Licence-Exempt Radio Apparatus: Category I Equipment, Issue 11, June 2024
Test Plan/Issue/Date	2024-June-21
Order Number	0721001855
Date	2024-June-28
Date of Receipt of EUT	2024-July-01
Start of Test	2024-July-02
Finish of Test	2024-July-12
Name of Engineer(s)	Thierry Jean-Charles
Related Document(s)	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2023. Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN - General Requirements for Compliance of Radio Apparatus, Issue 5, Amendment 1, March 2019, Amendment 2, February 2021.

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC Part 15.225 and ISED Canada's RSS-210 is shown below.

Table 1.3-1 – Test Result Summary

Test Parameter	Test Plan (Yes/No)	Test Result	FCC 47 CFR Rule Part	ISED Canada's RSS	Test Report Page No
Antenna Requirement	Yes	Pass	15.203, 15.204	-------	10
20 dB Bandwidth	Yes	Pass	15.215(c)	-------	11
99% Bandwidth	Yes	Pass	-------	RSS-GEN 6.7	13
Field strength of Emissions within the Band 13.110-14.010 MHz	Yes	Pass	15.225(a),(b),(c)	RSS-210 Annex B.6(a)	15
Field Strength of Emissions outside of the Band 13.110-14.010 MHz	Yes	Pass	15.209, 15.225(d)	RSS-210 7.2, RSS-210 Annex B.6(a), RSS-GEN 8.9	19
Power Line Conducted Emissions	Yes	Pass	15.207	RSS-GEN 8.8	26
Frequency Tolerance of the Carrier Signal	Yes	Pass	15.225(e)	RSS-210 B.6(b)	30

1.4 Product Information

1.4.1 Technical Description

The EUT was a 13.56 MHz RFID reader module.

Technical Details

Mode of Operation:	13.56 MHz RFID
Frequency Range:	13.56 MHz
Number of Channels:	1
Channel Separation:	N/A
Data Rate:	26 kbps
Modulations:	ASK
Antenna Type/Gain:	PCB Loop Antenna (27 mm x 21.6 mm)
Input Power:	5 VDC

A full description and detailed product specification details are available from the manufacturer.

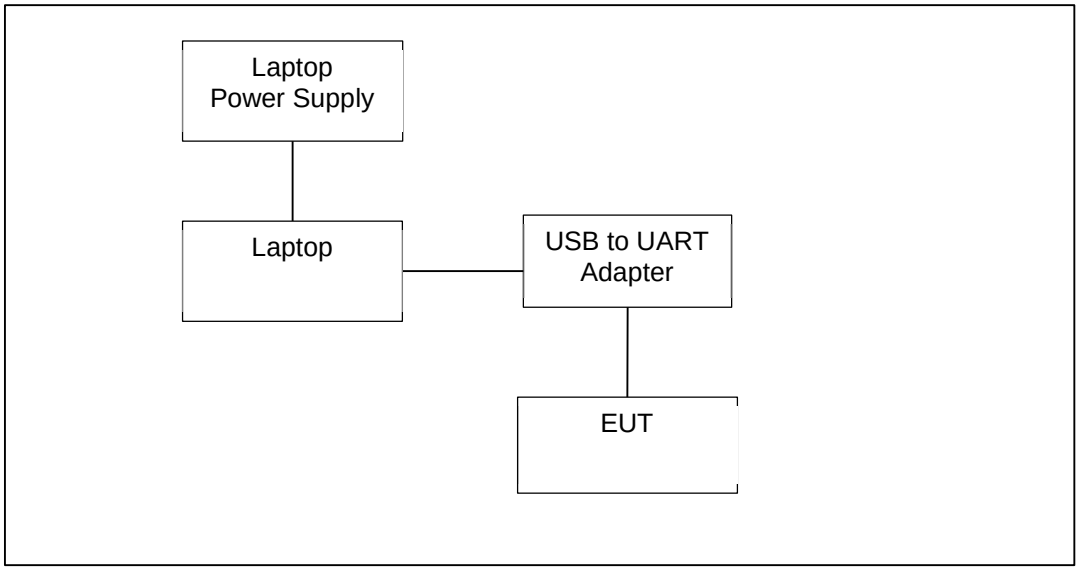

Figure 1.4.1-1 – Radiated Emissions Test Setup Diagram

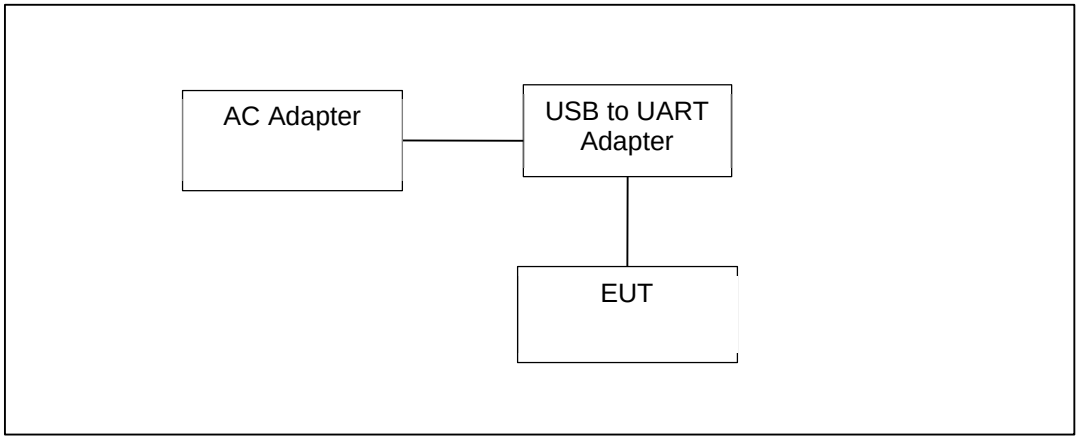

Figure 1.4.1-2 – Conducted Emissions Test Setup Diagram

Table 1.4.1-1 – Cable Descriptions

Cable/Port	Description
Ribbon cable	0.46 m (radiated emissions test), 0.1 m (conducted emissions test) - EUT to USB UART Adapter
Tripp Lite USB A to USB B cable model U023-00A	0.9 m, moulded ferrite - UART Adapter to Laptop (radiated emissions), UART Adapter to 5VDC Power Supply (conducted emissions)
DC Cable	1.83 m, power supply to laptop
AC Cable	1m, laptop power supply to AC Mains

Table 1.4.1-2 – Support Equipment Descriptions

Make/Model	Description
Awareness Technology	USB UART Adapter
Phihong / MQ05A-050A	5 VDC Switching Power Supply, S/N: M0039P231200544A1
Lenovo / T420	Laptop , S/N: 324
Lenovo / 42T4430	90W 20V AC Adapter, S/N: 11S42T4430Z1ZGWE1596PR REV F

Note: The laptop and DC power supplies were used for testing purposes.

Declaration of Build Status

EQUIPMENT DESCRIPTION	
Model Name/Number	RFID Reader MCU
Part Number	995801SMT
Hardware Version	184528SM RevC
Software Version	0.1.0
FCC ID (if applicable)	2BHQI-RFID58
ISED ID (if applicable)	
Technical Description (Please provide a brief description of the intended use of the equipment)	IVD Laboratory Equipment 13.56 MHz Module transceiver for use with NFC passive tags.

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	**48 MHz**
Lowest frequency generated or used in the device or on which the device operates or tunes	
Class A Digital Device (Use in commercial, industrial or business environment) ☒ Class B Digital Device (Use in residential environment only) ☐	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
	☒	☐	100-240
External DC	Nominal Voltage		Maximum Current
	5 VDC		1 A
Battery	Nominal Voltage		Battery Operating End Point Voltage

EXTREME CONDITIONS					
Maximum temperature	+50	°C	Minimum temperature	-20	°C

Ancillaries
Please list all ancillaries which will be used with the device.

I hereby declare that the information supplied is correct and complete.

Name: Chris Mauer

Position held: Engineer Date: Jan. 9, 2025

1.4.2 Modes of Operation

The evaluation was performed for the RFID radio transmitting continuously. The RFID radio was set to continuous scan mode using the RFID Module Manager software provided by the equipment manufacturer. The RF output power was not configurable.

1.4.3 Monitoring of Performance

For the power line conducted emissions, the EUT was evaluated with an off-the-shelf AC adpater, which was provided for testing purposes. The EUT was pre-programmed to transmit continuously.

For the radiated emissions, the EUT was evaluated while connected to a laptop computer via USB. A preliminary evaluation was performed for the EUT in multiple orientations. The final measurements were collected using the worst-case orientation.

1.4.4 Performance Criteria

The EUT was evaluated for the following performance criteria.

Table 1.4.4-1 – Performance Criteria

Parameter	Requirement
Antenna Requirement	FCC: Section 15.203. 15.204
20 dB Bandwidth	FCC: Section 15.215(c)
99% Bandwidth	ISED Canada: RSS-GEN 6.7
Radiated Field Strength of Emissions within the 13.110-14.010 MHz Band	FCC: Section 15.225 (a),(b),(c); ISED Canada: RSS-210 Annex B.6 (a)
Radiated Field Strength of Emissions outside of the 13.110-14.010 MHz Band	FCC: Section 15.209, 15.225; ISED Canada: RSS-210 7.2, RSS-210 Annex B.6 (a), RSS-GEN 8.9
Power Line Conducted Emissions	FCC: Section 15.207; ISED Canada: RSS-GEN 8.8
Frequency Tolerance of the Carrier Signal	FCC: Section 15.225(e); ISED Canada: RSS-210 B.6 (b)

1.5 Deviations from the Standard

The evaluation was performed without any deviations from the test standards.

1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
None			

The equipment was tested as provided without any modifications. However, a USB A to USB B cable with moulded ferrites on each end was used to meet the radiated emissions requirements above 30 MHz. The cable used was a Tripp Lite USB A to USB B cable model U023-00A.

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Tampa FL Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
DC Powered Operating		
Antenna Requirement	Thierry Jean-Charles	A2LA
20 dB Bandwidth	Thierry Jean-Charles	A2LA
99% Bandwidth	Thierry Jean-Charles	A2LA
Radiated Field Strength of Emissions within the 13.110-14.010 MHz Band	Thierry Jean-Charles	A2LA
Radiated Field Strength of Emissions outside of the 13.110-14.010 MHz Band	Thierry Jean-Charles	A2LA
Power Line Conducted Emissions	Thierry Jean-Charles	A2LA
Frequency Tolerance of Carrier Signal	Thierry Jean-Charles	A2LA

Office Address:

TÜV SÜD America, Inc.
5610 W. Sligh Ave, Suite 100
Tampa, FL 33634
USA

2 Test Details

2.1 Antenna Requirements

2.1.1 Specification Reference

FCC: Section 15.203, 15.204

2.1.2 Equipment Under Test and Modification State

SN: 1

2.1.3 Date of Test

2024-July-02

2.1.4 Test Method

N/A

2.1.5 Environmental Conditions

Ambient Temperature	N/A
Relative Humidity	N/A
Atmospheric Pressure	N/A

2.1.6 Test Results

Limit Clause FCC Sections: 15.203, 15,204

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The EUT uses a PCB loop antenna which is integral to the device PCB. The antenna is not replaceable and therefore meets the requirements of FCC Section 15.203.

2.1.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

As this was a visual inspection, no test equipment was used.

2.2 20 dB Bandwidth

2.2.1 Specification Reference

FCC: Section 15.215(c)

2.2.2 Equipment Under Test and Modification State

SN: 1

2.2.3 Date of Test

2024-July-02

2.2.4 Test Method

The 20 dB bandwidth was measured in accordance with ANSI C63.10 Subclause 6.9.2. The spectrum analyzer span was set between two times and five times the OBW. The RBW of the spectrum analyzer was set to 1% to 5% if the OBW. The VBW was approximately three times RBW. A peak detector was used for the measurements.

2.2.5 Environmental Conditions

Ambient Temperature	23.4°C
Relative Humidity	48.5 %
Atmospheric Pressure	1015.6 mbar

2.2.6 Test Results

DC Powered Operating

Limit Clause FCC Part 15.215

The intentional radiator must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated.

Table 2.2.6-1 – 20 dB Bandwidth Test Results

Frequency (MHz)	20 dB Bandwidth (Hz)
13.56	56.061

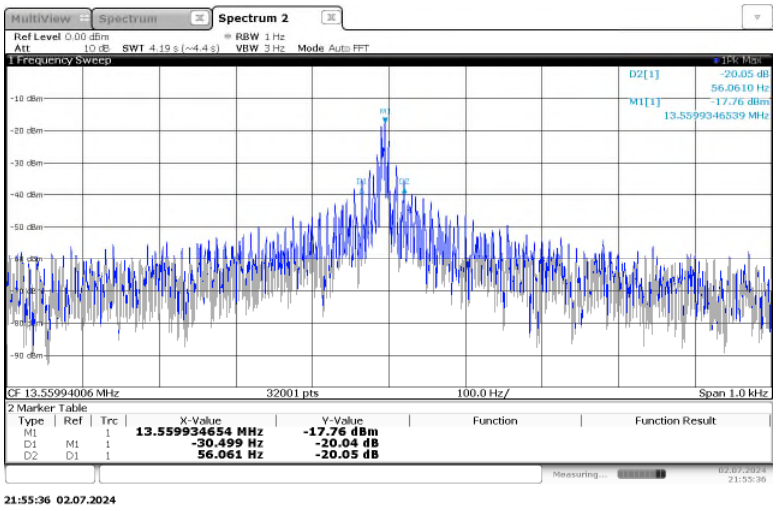

Figure 2.2.6-1 – 20 dB Bandwidth Test Results

2.2.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	12	03-Jun-2025
Flexible Test Cable	Mini-Circuits	ULC-8FT-SMSM+	TEMC00267	N/A	12	08-Mar-2025
SMA Fixed Attenuator Kit	Mini Circuits	K2-BW2+	TEMC00272	N/A	12	06-Apr-2025

TU - Traceability Unscheduled
O/P MON - Output Monitored with Calibrated Equipment
N/A - Not Applicable
NCR – No Calibration Required

2.3 99% Bandwidth

2.3.1 Specification Reference

ISED Canada: RSS-GEN 6.7

2.3.2 Equipment Under Test and Modification State

SN: 1

2.3.3 Date of Test

2024-July-02

2.3.4 Test Method

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission. The RBW was set to 1% to 5% of the approximated bandwidth. The occupied 99% bandwidth was measured by using 99% bandwidth equipment function of the spectrum analyzer using a peak detector.

2.3.5 Environmental Conditions

Ambient Temperature	23.4°C
Relative Humidity	48.5 %
Atmospheric Pressure	1015.6 mbar

2.3.6 Test Results

DC Powered Operating

Limit Clause ISED RSS-GEN 6.6

Table 2.3.6-1 – 99% dB Bandwidth Test Results

Frequency (MHz)	99% Bandwidth (Hz)
13.56	402.54

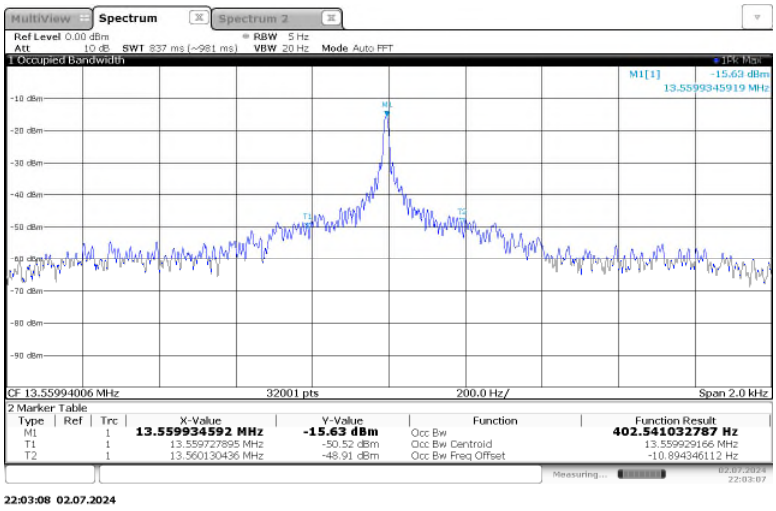

Figure 2.3.6-1 – 99% Bandwidth Test Results

2.3.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	12	03-Jun-2025
Flexible Test Cable	Mini-Circuits	ULC-8FT-SMSM+	TEMC00267	N/A	12	08-Mar-2025
SMA Fixed Attenuator Kit	Mini Circuits	K2-BW2+	TEMC00272	N/A	12	06-Apr-2025

TU - Traceability Unscheduled
O/P MON - Output Monitored with Calibrated Equipment
N/A - Not Applicable
NCR – No Calibration Required

2.4 Radiated Field Strength of Emissions within the 13.110-14.010 MHz Band

2.4.1 Specification Reference

FCC Sections: 15.225(a),(b),(c);
ISED Canada: RSS-210 Annex B.6(a)

2.4.2 Equipment Under Test and Modification State

SN: 1

2.4.3 Date of Test

2024-July-09 to 2024-July-12

2.4.4 Test Method

Radiated emissions tests were made over the frequency range of 13.110 to 14.010 MHz. The receive antenna height was set to 1 m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 9 kHz, and a Quasi-Peak detector was used.

2.4.5 Environmental Conditions

Ambient Temperature	22.8 °C
Relative Humidity	49.7 %
Atmospheric Pressure	1014.2 mbar

2.4.6 Test Results

DC Powered Operating

Limit Clause FCC Sections 15.225 (a),(b),(c), ISED Canada: RSS-210 Annex B.6 (a)

Frequency (MHz)	Field Strength (microvolts/meter)	Field Strength (dBuV/m)	Measurement Distance (meters)
13.110 – 13.410	106	40.5	30
13.410 – 13.553	334	50.5	30
13.553 – 13.567	15,848	84	30
13.567 – 13.710	334	50.5	30
13.710 – 14.010	106*	40.5	30

Radiated measurements were performed at a distance closer than 30m as required, according to Part 15.209. Therefore, a correction factor was applied to account for propagation loss at the specified distance. The propagation loss was determined by using the square of an inverse linear distance

extrapolation factor (40dB/decade) according to 15.31. A sample calculation of the distance correction factor is shown below for limits expressed at a 30m measurement distance.

Distance correction factor (30m Specified Test Distance) = 40*Log (Test Distance/30)
= 40*Log (3/30)
= - 40 dB

Table 2.4.6-1 – Radiated Field Strength of Emissions within the 13.110-14.010 band

Frequency (MHz)	QuasiPeak (dBµV/m)	Pol	Limit (dBµV/m)	Margin (dB)	Azimuth (deg)	Corr. (dB/m)
13.245000	14.11	V	80.51	66.40	0.0	11.1
13.348000	27.30	V	80.51	53.21	0.0	11.1
13.552000	36.40	V	90.48	54.08	0.0	11.1
13.560000	56.07	V	124.00	67.93	0.0	11.1
13.568000	35.90	V	90.48	54.58	0.0	11.1
13.599000	24.50	V	90.48	65.98	348.0	11.1
13.772000	29.20	V	80.51	51.31	0.0	11.1
13.779000	22.50	V	80.51	58.01	0.0	11.1
13.865000	14.52	V	80.51	65.99	0.0	11.1

Notes:

- The measurements were performed at ta test distance of 3m. The limits are corrected using a distance correction factor of 40 dB per decade as described above.
- The results are reported for the worst case receive loop antenna orientation.

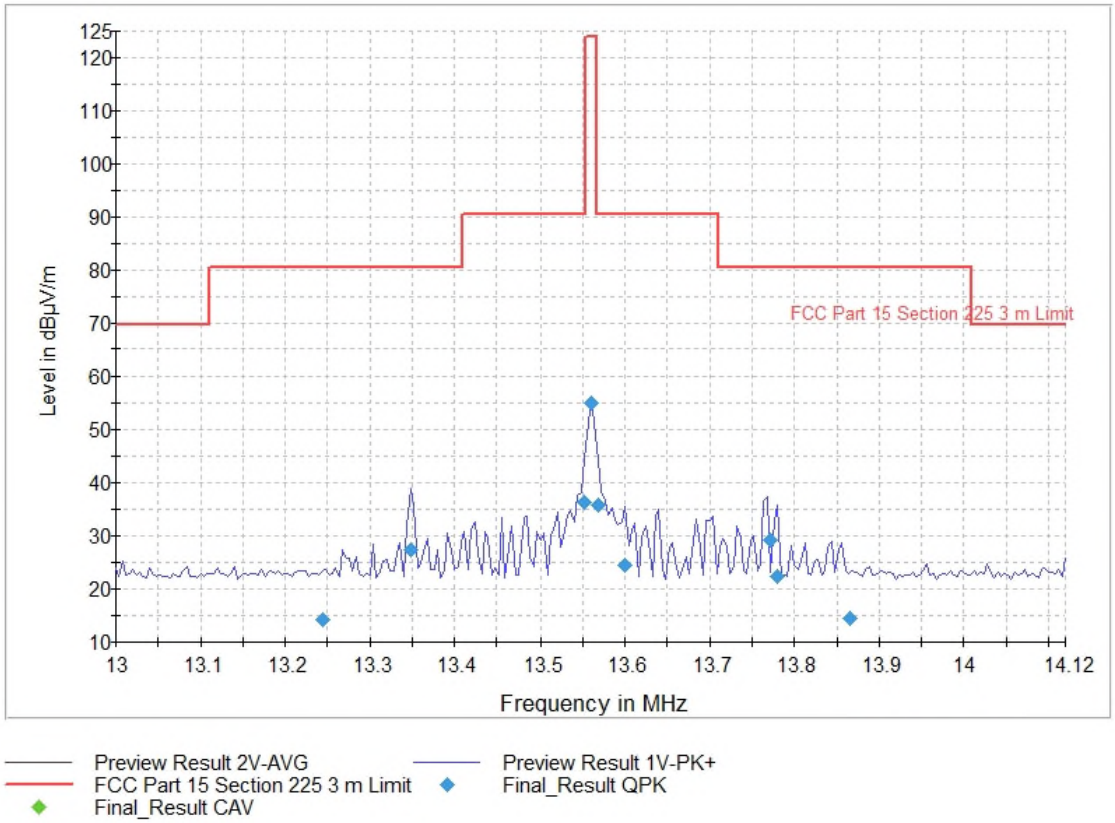

Figure 2.4.6-1 – Radiated Field Strength of Emissions within the 13.110-14.010 MHz band

2.4.7 Sample Calculations

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Quasi-Peak
Corrected Level: 44.97 + 11.1 = 56.07 dBµV/m
Margin: 124 dBµV/m – 56.07 dBµV/m = 67.93 dB

2.4.8 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Active Loop Antenna	EMCO	6502	BEMC00078	N/A	24	06-Sep-2025
100Hz-26.5GHz EMC analyzer/HYZ	Hewlett Packard	E7405A	BEMC00523	A.14.06	12	10-Jan-2025
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	16-Oct-2025
EMC Chamber	Panashield	N/A	TEMC00031	N/A	24	19-Oct-2025
Test Software	Rohde & Schwarz	EMC32	N/A	10.60.00	N/A	NCR
R & S ESW EMI Test Receiver	Rohde & Schwarz	ESW	TEMC00232	2.00 SP1	12	04-Jun-2025
DC to 18 GHz Cable	SSI Technologies	2801-03-03-360/WN	TEMC00293	N/A	12	05-Apr-2025

TU - Traceability Unscheduled
O/P MON - Output Monitored with Calibrated Equipment
N/A - Not Applicable
NCR – No Calibration Required

2.5 Radiated Field Strength of Emissions outside of the 13.110-14.010 MHz Band

2.5.1 Specification Reference

FCC Sections: 15.225(d), 15.209;
ISED Canada: RSS-210 7.2, RSS-210 Annex B.6(a), RSS-GEN 8.9

2.5.2 Equipment Under Test and Modification State

SN: 1

2.5.3 Date of Test

2024-July-09 to 2024-July-12

2.5.4 Test Method

Radiated emissions tests were made over the frequency range of 9 kHz to 1 GHz, 10 times the highest fundamental frequency. Each emission was compared to the radiated emission limits as defined in Section 15.209.

For measurements below 30 MHz, the receive antenna height was set to 1 m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz.

2.5.5 Duty Cycle Correction

The EUT was configured to transmit at maximum 44.62% duty cycle during the evaluation. No Duty Cycle Correction was used during the measurements for the corrected average results.

2.5.6 Environmental Conditions

Ambient Temperature	22.8 °C
Relative Humidity	49.9 %
Atmospheric Pressure	1014.1 mbar

2.5.7 Test Results

DC Powered Operating

Limit Clause FCC Sections 15.209, 15.225(d), ISED Canada: RSS-210 7.2, RSS-GEN 8.9

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.4090-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Radiated measurements were performed at a distance closer than 300 meters and 30m as required, according to Part 15.209. Therefore, a correction factor was applied to account for propagation loss at the specified distance. The propagation loss was determined by using the square of an inverse linear distance extrapolation factor (40dB/decade) according to 15.31. A sample calculation of the distance correction factor is shown below for limits expressed at a 300m measurement distance and a 30m measurement distance.

Distance correction factor (300m Specified Test Distance) = 40*Log (Test Distance/300)
= 40*Log (3/300)
= - 80 dB

Distance correction factor (30m Specified Test Distance) = 40*Log (Test Distance/30)
= 40*Log (3/30)
= - 40 dB

Table 2.5.7-1 – Transmitter Radiated Spurious Emissions below 30 MHz – Quasi-Peak

Frequency (MHz)	QuasiPeak (dBµV/m)	Pol	Azimuth (deg)	Corr. (dB/m)	Limit (dBµV/m)	Margin (dB)
0.657000	47.83	V	78.0	10.2	71.25	23.42
0.665000	45.73	V	0.0	10.2	71.15	25.42
0.881000	44.68	V	120.0	10.2	68.71	24.03
0.973000	45.42	V	160.0	10.4	67.84	22.42
13.561000	56.07	V	0.0	11.1	124.00	67.93
27.120000	30.01	V	147.0	9.4	69.5	39.49

Table 2.5.7-2 – Transmitter Radiated Spurious Emissions below 30 MHz - Average

Frequency (MHz)	Average (dBµV/m)	Pol	Azimuth (deg)	Corr. (dB/m)	Limit (dBµV/m)	Margin (dB)
0.365000	47.82	V	152.0	10.0	96.36	48.53

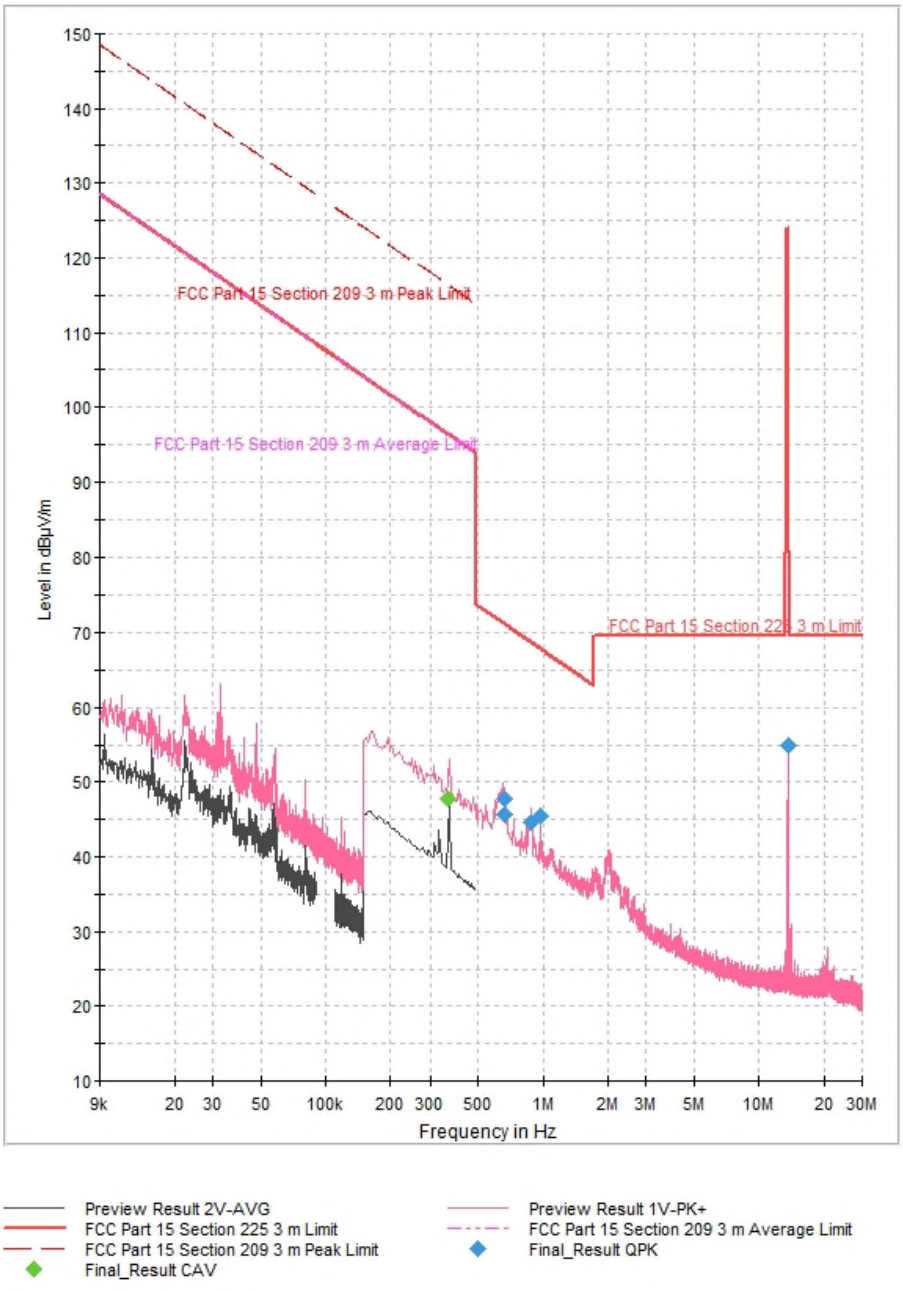

Figure 2.5.7-1 – Transmitter Radiated Spurious Emissions above 30 MHz

Table 2.5.7-3 – Transmitter Radiated Spurious Emissions above 30 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Limit (dBµV/m)	Margin (dB)
32.970000	30.82	115.0	V	174.0	24.3	40.00	9.18
36.030000	28.10	100.0	V	146.0	22.6	40.00	11.90
38.400000	28.76	100.0	V	126.0	21.2	40.00	11.24
47.970000	34.36	137.0	V	90.0	15.7	40.00	5.64
48.030000	37.30	100.0	V	132.0	15.6	40.00	2.70
54.240000	20.14	101.0	V	150.0	13.2	40.00	19.86
96.060000	30.29	184.0	V	192.0	16.7	43.50	13.21
96.090000	30.97	322.0	H	331.0	16.7	43.50	12.53
480.000000	36.50	197.0	H	220.0	25.1	46.00	9.50
492.000000	35.10	200.0	H	212.0	25.2	46.00	10.90
503.970000	33.30	100.0	H	53.0	25.2	46.00	12.70
516.000000	30.30	100.0	H	43.0	25.1	46.00	15.70
959.970000	31.80	100.0	H	193.0	29.5	46.00	14.20

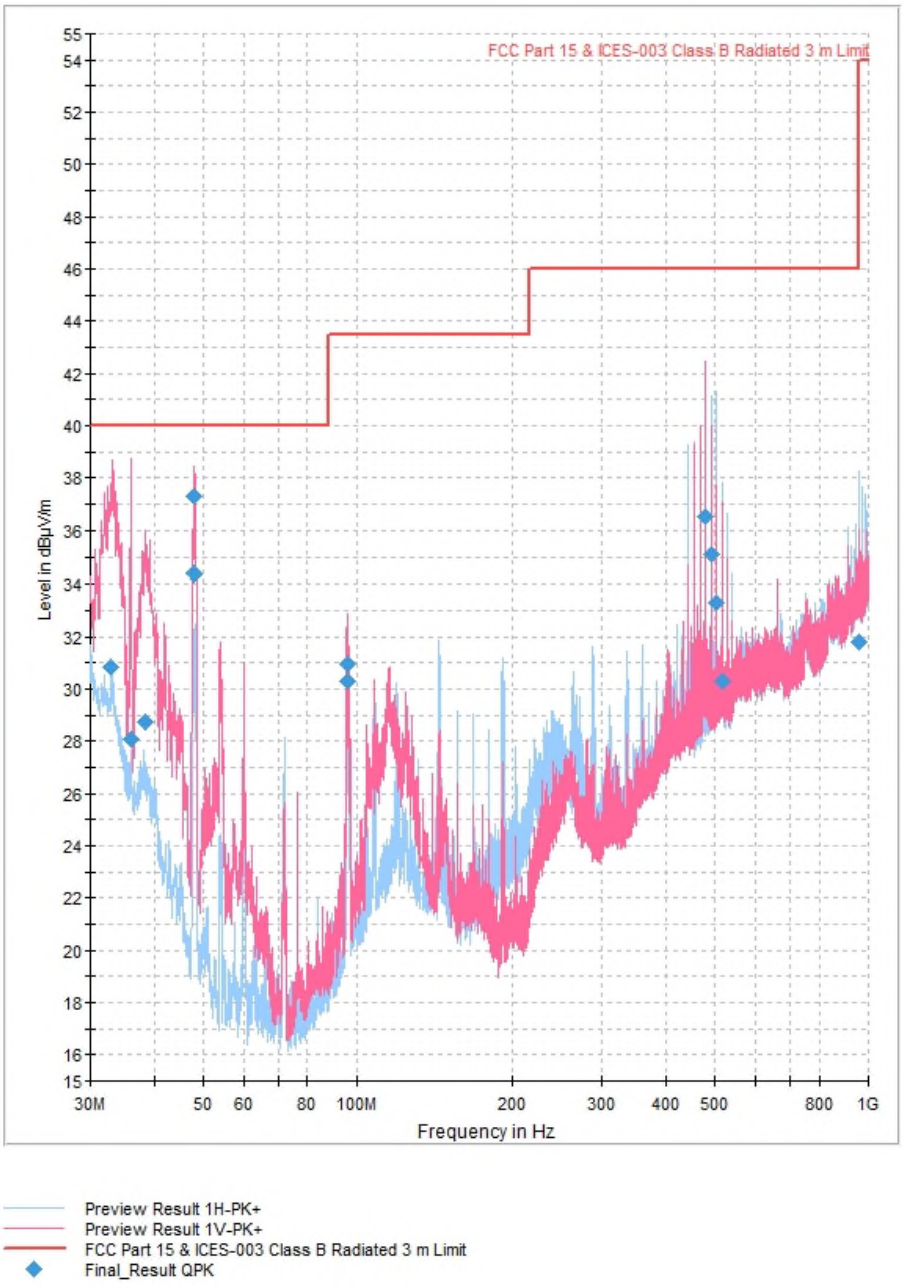

Figure 2.5.7-2 – Transmitter Radiated Spurious Emissions above 30 MHz

2.5.8 Sample Calculations

$R_C = R_U + CF_T$

Where:
CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U = Uncorrected Reading
R_C = Corrected Level
AF = Antenna Factor
CA = Cable Attenuation
AG = Amplifier Gain
DC = Duty Cycle Correction Factor

Example Calculation: Quasi-Peak
Corrected Level: 21.7 + 15.6 = 37.3 dBµV/m
Margin: 40 dBµV/m – 37.3 dBµV/m = 2.7 dB

2.5.9 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Active Loop Antenna	EMCO	6502	BEMC00078	N/A	24	06-Sep-2025
100Hz-26.5GHz EMC analyzer/HYZ	Hewlett Packard	E7405A	BEMC00523	A.14.06	12	10-Jan-2025
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	07-Nov-2025
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	16-Oct-2025
EMC Chamber	Panashield	N/A	TEMC00031	N/A	24	19-Oct-2025
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR
R & S ESW EMI Test Receiver	Rohde & Schwarz	ESW	TEMC00232	2.00 SP1	12	04-Jun-2025
DC to 18 GHz Cable	SSI Technologies	2801-03-03-360/WN	TEMC00293	N/A	12	05-Apr-2025

TU - Traceability Unscheduled
O/P MON - Output Monitored with Calibrated Equipment
N/A - Not Applicable
NCR – No Calibration Required

2.6 Power Line Conducted Emissions

2.6.1 Specification Reference

FCC: Section 15.207
ISED Canada; RSS-GEN 8.8

2.6.2 Equipment Under Test and Modification State

S/N: 3

2.6.3 Date of Test

2024-July-09

2.6.4 Test Method

ANSI C63.10 section 6.2 was the guiding document for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

2.6.5 Environmental Conditions

Ambient Temperature	22.8 °C
Relative Humidity	49.7 %
Atmospheric Pressure	1014.2 mbar

2.6.6 Test Results

Limit Clause FCC Sections 15.207, ISED Canada: RSS-GEN 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Table 2.6.6-1 – Power Line Conducted Emissions – Quasi-Peak Detector Results

Frequency (MHz)	Quasi-peak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154500	31.94	N	20.0	33.81	65.75
0.465000	34.52	N	19.9	22.08	56.60
0.492000	42.10	N	19.9	14.03	56.13
0.933000	30.86	N	19.8	25.14	56.00
1.423500	29.40	N	19.8	26.60	56.00
2.539500	28.25	N	19.8	27.75	56.00
3.628500	26.99	N	19.9	29.01	56.00
13.560000	48.81	L1	20.3	11.19	60.00

Table 2.6.6-2 – Power Line Conducted Emissions – Average Detector Results

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.442500	32.36	N	19.9	14.65	47.02
0.492000	41.44	N	19.9	4.69	46.13
0.496500	34.67	N	19.9	11.39	46.06
0.519000	40.95	N	19.9	5.05	46.00
0.955500	29.74	N	19.8	16.26	46.00
1.477500	27.63	N	19.8	18.37	46.00
2.539500	27.10	N	19.8	18.90	46.00
4.092000	24.64	N	19.9	21.36	46.00
13.555500	41.33	N	20.3	8.67	50.00
27.118500	24.28	N	20.7	25.72	50.00

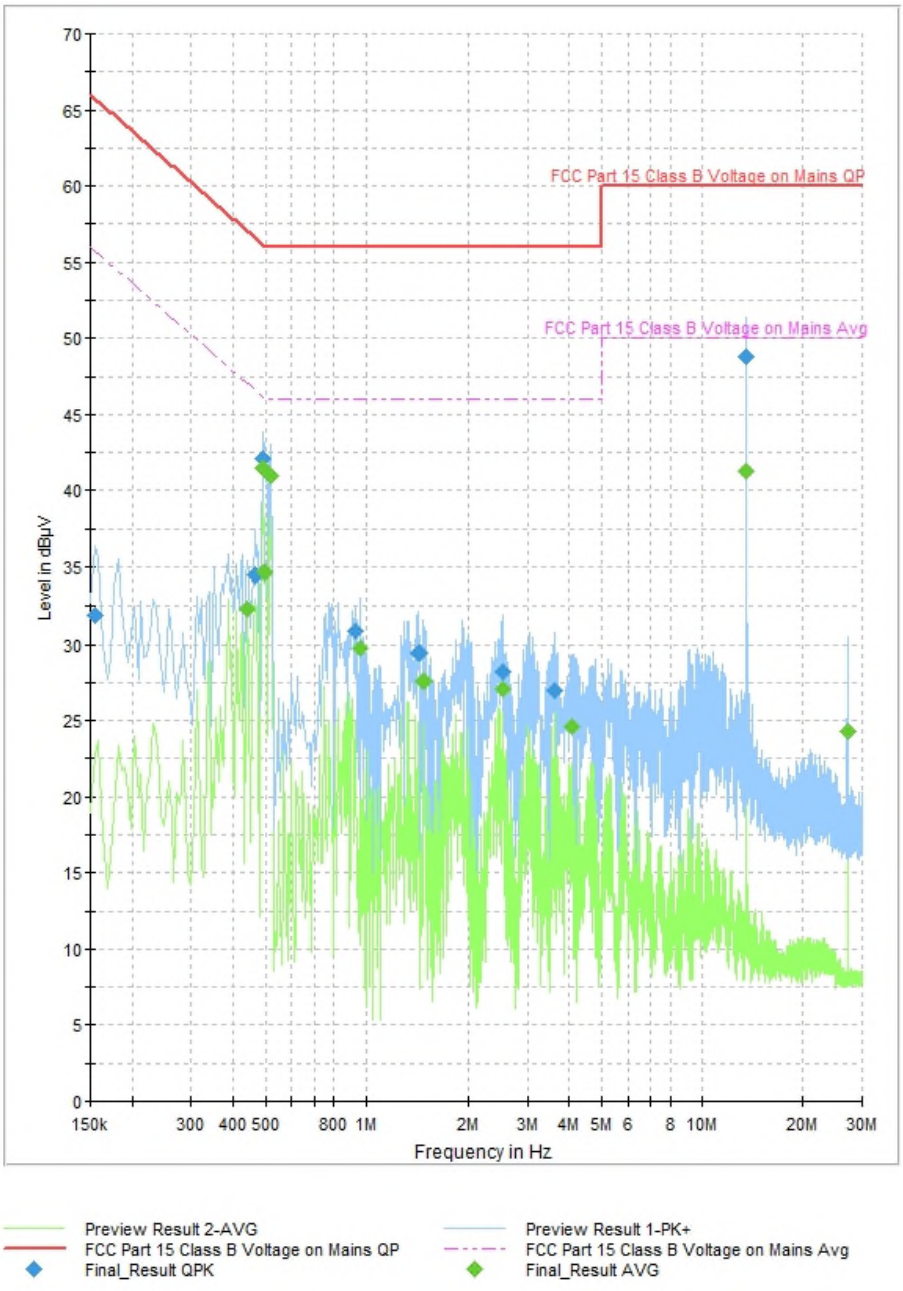

Figure 2.6.6-1 – Composite Power Line Conducted Emissions Plot

2.6.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3003.0203.36	12	22-Jan-2025
EMC Analyzer	Hewlett Packard	E7405A	TEMC00012	A.09.02	12	23-Jan-2025
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
Test Software	Rohde & Schwarz	EMC32	N/A	10.50.00	N/A	NCR
Two-Line Network	Rohde & Schwarz	ENV-216	TEMC00290	N/A	12	06-Oct-2024
Conducted cable with UNAT-10+ attenuator	L-com	RG58C/U	TEMC00291	N/A	12	23-Oct-2024

TU - Traceability Unscheduled
O/P MON - Output Monitored with Calibrated Equipment
N/A - Not Applicable
NCR – No Calibration Required

2.7 Frequency Tolerance of Carrier Signal

2.7.1 Specification Reference

FCC Section 15.225(e);
ISED Canada RSS-210 Annex B.6(b)

2.7.2 Equipment Under Test and Modification State

Serial Number: 1

2.7.3 Date of Test

2024-July-02

2.7.4 Test Method

Frequency stability measurements with respect to ambient temperature and when varying voltage were performed in accordance with ANSI C63.10 section 6.8 and ISED Canada RSS-GEN 6.11. The measurements were performed using a spectrum analyzer. Sufficient stabilization period was used at each temperature prior to each measurement.

2.7.5 Environmental Conditions

Ambient Temperature	23.4 °C
Relative Humidity	48.5 %
Atmospheric Pressure	1015.6 mbar

2.7.6 Test Results

Limit Clause FCC Sections 15.225(e),ISED Canada: RSS-210 B.6 (b)

	Carrier Frequency Tolerance Limits	
Temperature Range	FCC 15.225 (e)	RSS-210 B6 (b)
-20 C to +50C	0.01%	100 ppm

Frequency Stability

Frequency (MHz): 13.559948
Deviation Limit (%): 0.01
Deviation Limit (PPM): 100.00
Nominal Voltage (VDC): 5

Temperature	Frequency	Frequency Error		Voltage	Voltage
C	MHz	(%)	PPM	(%)	(VDC)
-20 C	**13.559877**	**-0.00052**	**-5.23601**	100%	5.00
-10 C	**13.559855**	**-0.00069**	**-6.85843**	100%	5.00
0 C	**13.559854**	**-0.00069**	**-6.93218**	100%	5.00
10 C	**13.559854**	**-0.00069**	**-6.93218**	100%	5.00
20 C	**13.559948**	**0.00000**	**0.00000**	100%	5.00
30 C	**13.559915**	**-0.00024**	**-2.43364**	100%	5.00
40 C	**13.559884**	**-0.00047**	**-4.71978**	100%	5.00
50 C	**13.559861**	**-0.00064**	**-6.41595**	100%	5.00
20 C	**13.559950**	**0.00001**	**0.14749**	85%	4.25
20 C	**13.559857**	**-0.00067**	**-6.71094**	115%	5.75

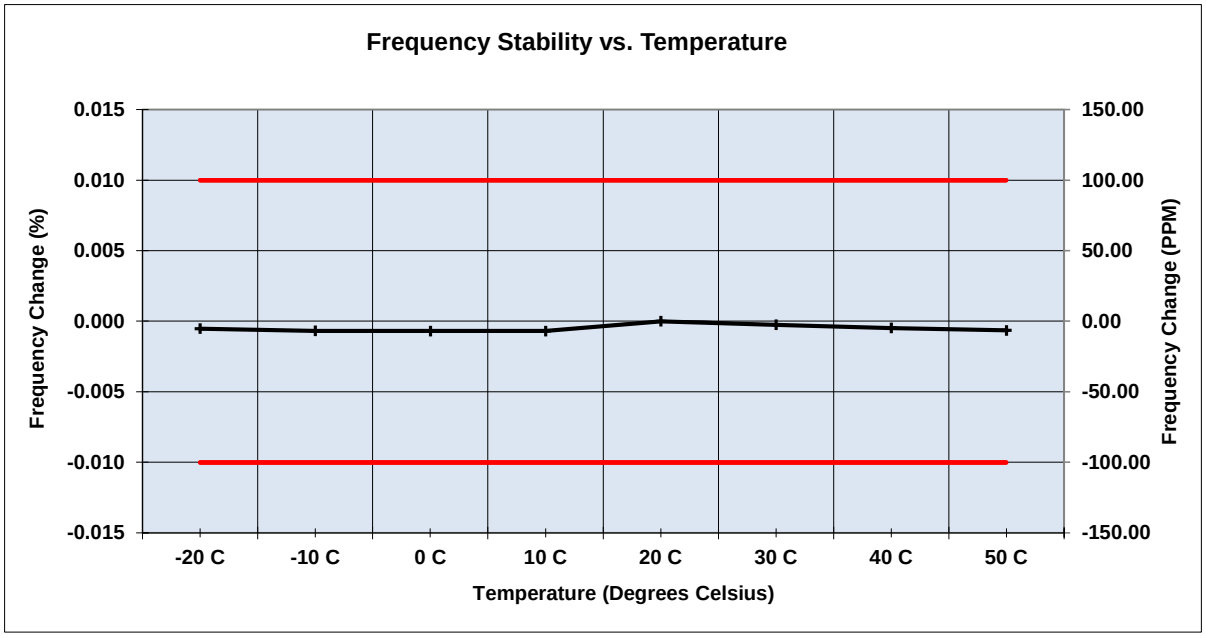

Figure 2.7.6-1 – Frequency Tolerance of Carrier Signal Result

2.7.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Digital Thermometer	Omega Engineering, Inc.	MDSS41-TC	BEMC00002	N/A	24	19-Sep-2025
Digital MultiMeter	Fluke	115	BEMC02108	N/A	12	25-Jan-2025
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR, O/P MON
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	12	03-Jun-2025
DC Power Supply	Xantrex	HPD-60-5	TAME01064	N/A	N/A	NCR, O/P MON
Temperature Test Chamber	Sun Electronic Systems, Inc.	EC127	TEMC00242	5.10	N/A	NCR, O/P MON
Flexible Test Cable	Mini-Circuits	ULC-8FT-SMSM+	TEMC00267	N/A	12	08-Mar-2025
SMA Fixed Attenuator Kit	Mini Circuits	K2-BW2+	TEMC00272	N/A	12	06-Apr-2025

TU - Traceability Unscheduled
O/P MON - Output Monitored with Calibrated Equipment
N/A - Not Applicable
NCR – No Calibration Required

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Digital Thermometer	Omega Engineering, Inc.	MDSS41-TC	BEMC00002	N/A	24	19-Sep-2025
Digital MultiMeter	Fluke	115	BEMC02108	N/A	12	25-Jan-2025
PCB Loop Antenna	FAU EMI R&D Lab	EMI-LOOP	BEMC02141	N/A	N/A	NCR, O/P MON
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	2.90 SP1	12	03-Jun-2025
DC Power Supply	Xantrex	HPD-60-5	TAME01064	N/A	N/A	NCR, O/P MON
Temperature Test Chamber	Sun Electronic Systems, Inc.	EC127	TEMC00242	5.10	N/A	NCR, O/P MON
Flexible Test Cable	Mini-Circuits	ULC-8FT-SMSM+	TEMC00267	N/A	12	08-Mar-2025
SMA Fixed Attenuator Kit	Mini Circuits	K2-BW2+	TEMC00272	N/A	12	06-Apr-2025
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3003.0203.36	12	22-Jan-2025
EMC Analyzer	Hewlett Packard	E7405A	TEMC00012	A.09.02	12	23-Jan-2025
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
Test Software	Rohde & Schwarz	EMC32	N/A	10.50.00	N/A	NCR
Two-Line Network	Rohde & Schwarz	ENV-216	TEMC00290	N/A	12	06-Oct-2024
Conducted cable with UNAT-10+ attenuator	L-com	RG58C/U	TEMC00291	N/A	12	23-Oct-2024
Active Loop Antenna	EMCO	6502	BEMC00078	N/A	24	06-Sep-2025
100Hz-26.5GHz EMC analyzer/HYZ	Hewlett Packard	E7405A	BEMC00523	A.14.06	12	10-Jan-2025
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	07-Nov-2025
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	16-Oct-2025
EMC Chamber	Panashield	N/A	TEMC00031	N/A	24	19-Oct-2025
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR
R & S ESW EMI Test Receiver	Rohde & Schwarz	ESW	TEMC00232	2.00 SP1	12	04-Jun-2025
DC to 18 GHz Cable	SSI Technologies	2801-03-03-360/WN	TEMC00293	N/A	12	05-Apr-2025

TU - Traceability Unscheduled
O/P MON - Output Monitored with Calibrated Equipment
N/A - Not Applicable
NCR – No Calibration Required

4 Diagram of Test Set-ups

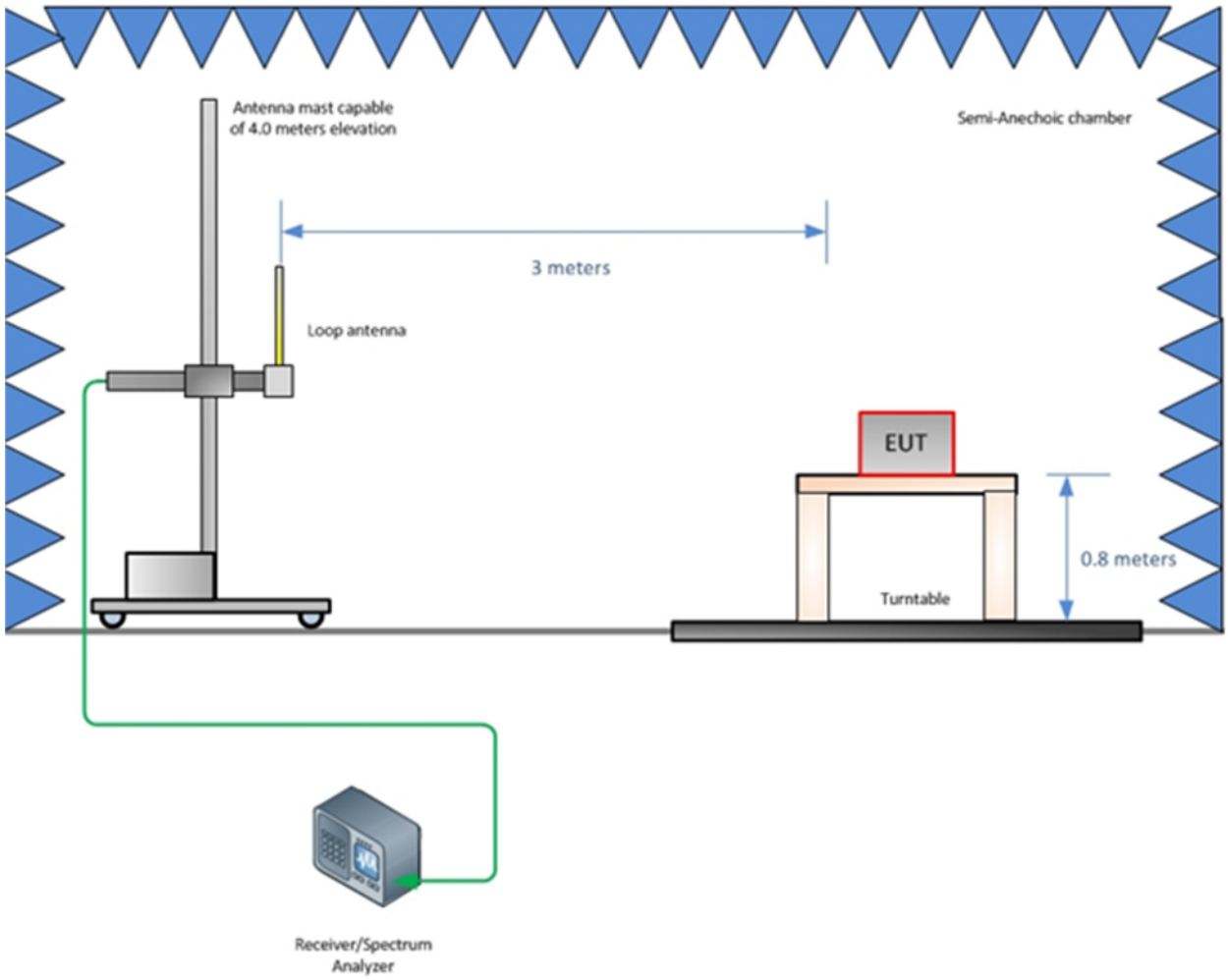

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Figure 4-1 - Radiated Emissions Test Setup up to 30 MHz

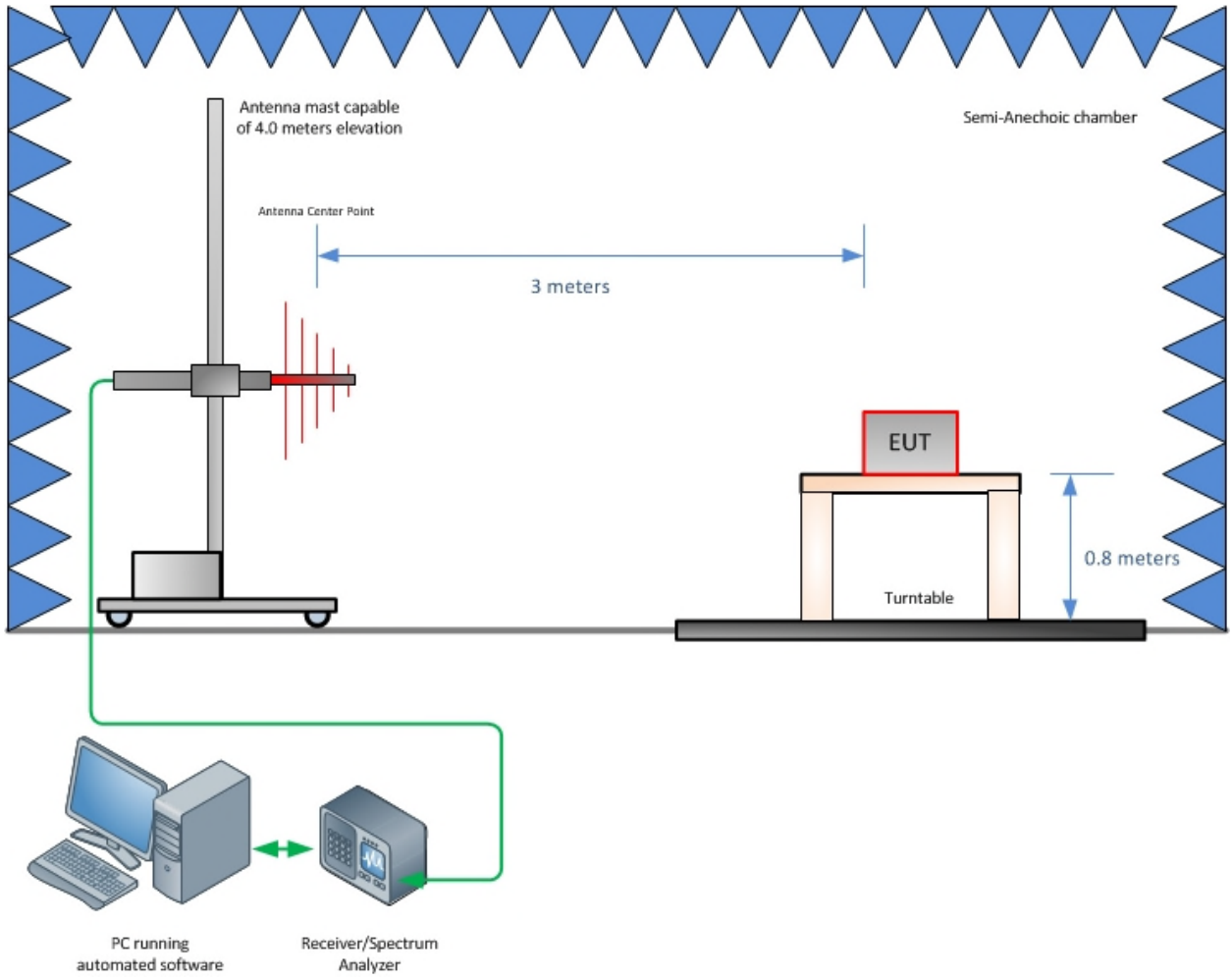

Figure 4-2 - Radiated Emissions Test Setup up to 1 GHz

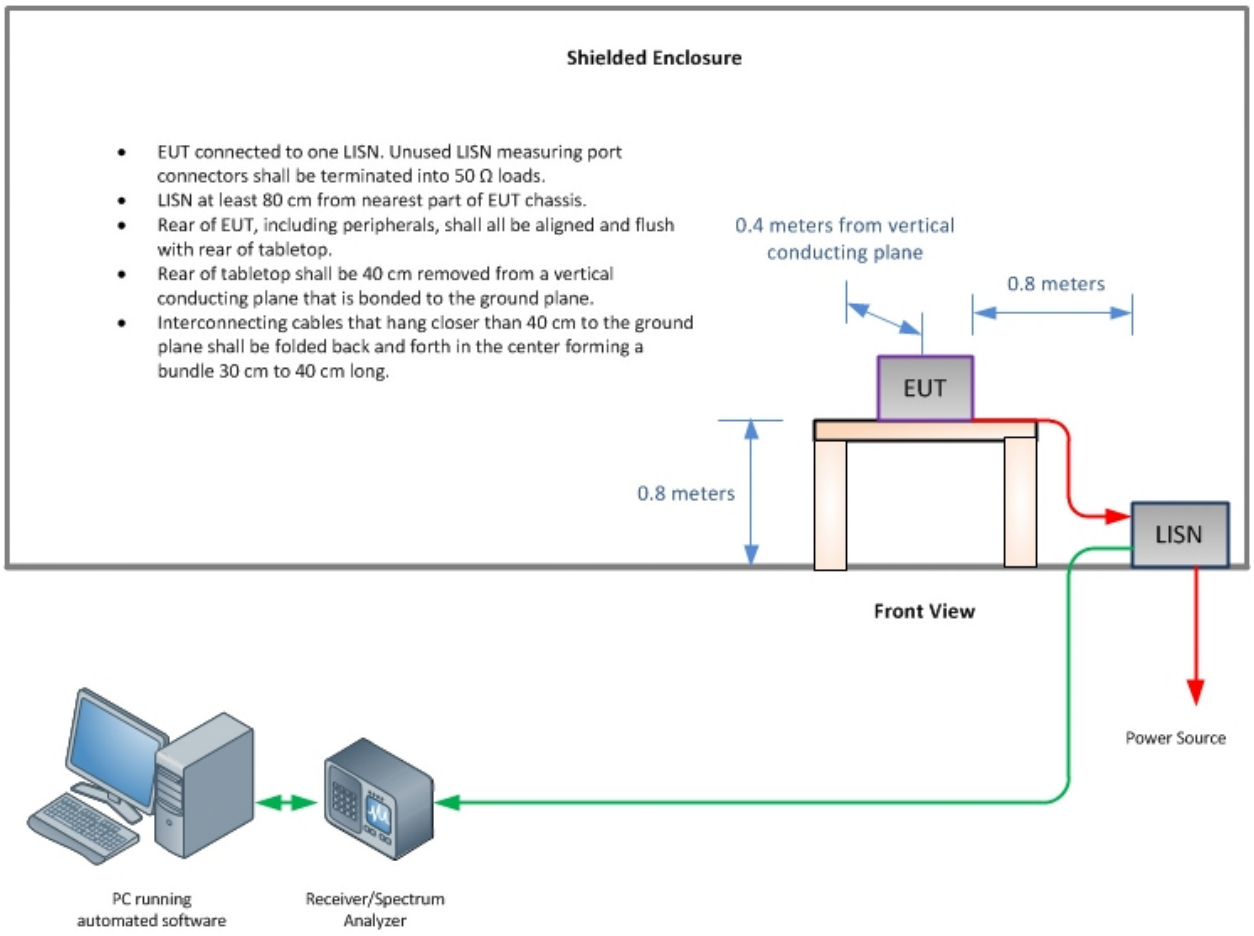

Figure 4-3 - Conducted Emissions Test Setup

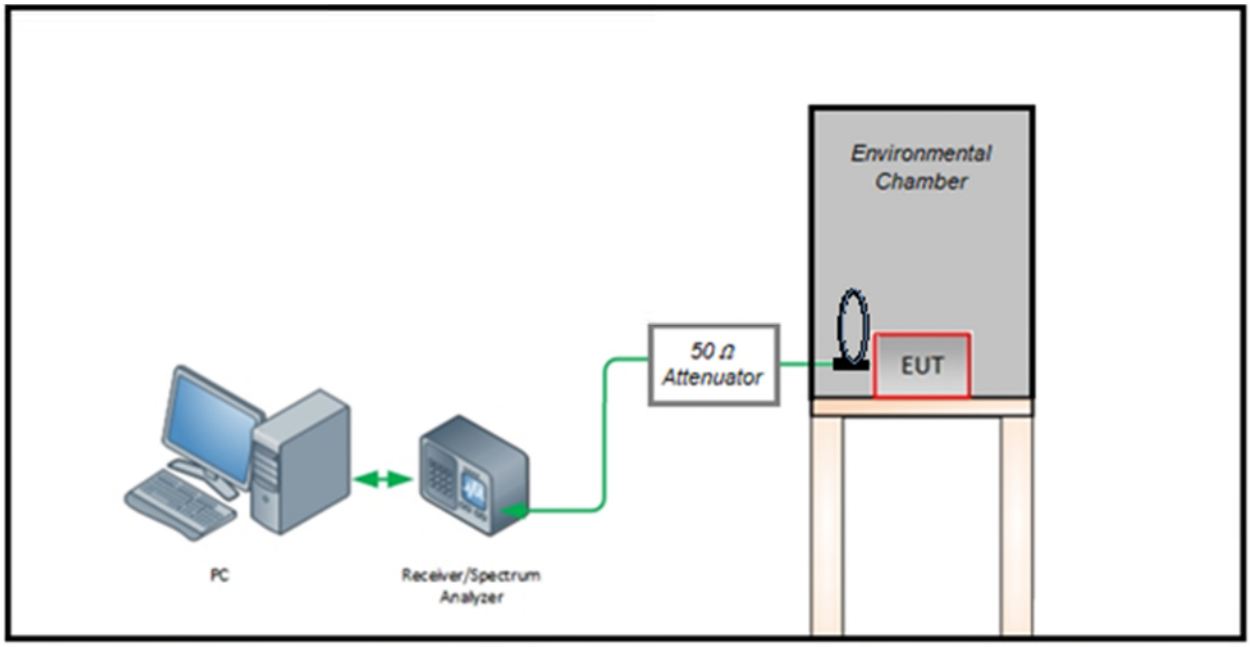

Figure 4-4 – Frequency Stability Test Setup

5 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Table 5-1 - Values of U_{cispr} and U_{Lab}

Measurement	U_{cispr}	U_{Lab}
Conducted disturbance (mains port) (9 kHz – 150 kHz) (150 kHz – 30 MHz)	 3.8 dB 3.4 dB	 3.71 dB 3.31 dB
Conducted disturbance (telecom port) (150 kHz – 30 MHz 55 dB LCL) (150 kHz – 30 MHz 65 dB LCL) (150 kHz – 30 MHz 75 dB LCL)	 5.0 dB 5.0 dB 5.0 dB	 4.11 dB 4.50 dB 4.94 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1 000 MHz) (1 – 6 GHz) (6-18 GHz)	 6.3 dB 5.2 dB 5.5 dB	 5.94 dB 5.07 dB 5.07 dB

Notes:

U_{cispr} resembles a value of measurement uncertainty for a specific test, which was determined by considering uncertainties associated with the quantities listed in CISPR 16-4-2:2011.

6 Accreditation, Disclaimers and Copyright

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